

REMARKS

Claims 1-4, 14-16, 27, 36, and 40-42 are rejected under 35 USC §103 as being unpatentable over Applicant's Admission of Prior Art (AAPA) in view of Wojnarowski et al., U.S. 5,737,458.

Independent claim 1 recites an optical chip including at least one large mode field size dielectric waveguide to interface with an external optical device. At least one low minimum bending radius dielectric waveguide is coupled to the large mode field size dielectric waveguide. The at least one large mode field size dielectric waveguide comprises a low index difference waveguide and the optical device comprises a low index difference waveguide. At least one optical function is connected to the low minimum bending radius dielectric waveguide. The large mode field size dielectric waveguide, the low minimum bending radius dielectric waveguide, and the optical function are fabricated monolithically on a single substrate.

Independent claim 36 recites an apparatus that includes a first optical chip. The first optical chip includes at least one large mode size dielectric waveguide. At least one low minimum bending radius dielectric waveguide is coupled to the large mode size dielectric waveguide. The at least one large mode field size dielectric waveguide comprises a low index difference waveguide and is coupled to an optical device that comprises a low index difference waveguide. At least one optical function is connected to the low minimum bending radius dielectric waveguide. The optical function, large mode size dielectric waveguide, and low minimum bending radius dielectric waveguide are monolithically fabricated on a single

substrate. A second optical chip includes an emitting/receiving optical device to optically connect to the large mode size dielectric waveguide of the first optical chip.

Independent claim 40 recites an apparatus that includes a first optical chip. The first optical chip includes at least one large mode size dielectric waveguide. At least one low minimum bending radius dielectric waveguide is coupled to the large mode size dielectric waveguide. At least one optical function is connected to the low minimum bending radius dielectric waveguide. The least one large mode field size dielectric waveguide comprises a low index difference waveguide and the external optical device comprises a low index difference waveguide. The optical function, large mode size dielectric waveguide, and low minimum bending radius dielectric waveguide are monolithically fabricated on a single substrate. At least one external large mode field size dielectric waveguide is external to the optical chip and being optically connected to the optical chip.

Wojnarowski et al. '458 describes HDI fabrication techniques that are employed to form a variety of optical waveguide structures in polymer materials. Adaptive optical connections are formed, taking into account the actual position and orientation of devices that may deviate from the ideal. Structures include solid light-conducting structures, hollow light-conducting structures which are also suitable for conducting cooling fluid, and optical switching devices employing liquid crystal material. A "shrink back" method may be used to form a tunnel in polymer material which is then filled with an uncured polymer material that shrinks upon curing.

The AAPA, as stated by the Examiner, does not recite that the large mode field size dielectric waveguide, the low minimum bending radius dielectric waveguide, and the optical function are fabricated monolithically on a single substrate. In contrast, Wojnarowski et al. '458

teaches HDI fabrication techniques that are employed to form a variety of optical waveguide structures in polymer materials. In particular, Wojnarowski et al. '458 describes in FIG. 1 a HDI module 30 that interconnects optical waveguides 42 and various devices. It will be appreciated that independent claims 1, 36, and 40 recite the use of a large mode field size dielectric waveguide, a low minimum bending radius dielectric waveguide, and an optical function. In particular, a large mode field size dielectric waveguide

In the AAPA, Applicants have spelled out the difficulties of monolithically combining a large mode field size dielectric waveguide, a low minimum bending radius dielectric waveguide, and an optical function. Note Wojnarowski et al. '458 does not even address these concerns. The AAPA describes that high index waveguides used for reducing minimum bending radii have drawbacks because the fiber optic waveguides used for input and output from optical chip are typically low index difference waveguides, a higher loss results in the coupling between the low index difference optical fiber waveguides and the high index difference waveguides on the optical chip. In addition, scattering loss increases for higher index difference waveguides. Wojnarowski et al. '458 is silent on those issues and does not even provide a hint of the problems of monolithically combining a large mode field size dielectric waveguide, a low minimum bending radius dielectric waveguide, and an optical function, as clearly articulated in the AAPA.

Independent claims 1, 36, and 40 have now been amended to recite that the least one large mode field size dielectric waveguide comprises a low index difference waveguide and the external optical device comprises a low index difference waveguide. AAPA does not address the

issue having a large mode field size dielectric waveguide being a low index difference waveguide but a high index difference waveguide.

Thus, the combination of AAPA and Wojnarowski et al. '458 does not render claims 1, 36, and 40 obvious.

As to claims 2-4, 14-16, 27, and 41-42, they are dependent on claims 1, 36, and 40, respectively. Therefore, claims 2-4, 14-16, 27, and 41-42 are also allowable for the same reasons argued with respect to claims 1, 36, and 40.

Claims 5-13 are rejected under 35 USC 103 as being unpatentable over AAPA and Wojnarowski et al '458 in view of Hammer, U.S. 4,776,720.

Hammer '720 describes a waveguide includes a substrate having a major surface and a waveguide layer on the surface of the substrate. At least one confinement layer is on the waveguide layer and includes a transition region. The transition region is an extension of the confinement layer which tapers in width from the width of the confinement layer to a point. The waveguide layer may include a second confinement layer on the waveguide layer which is of a width different from the width of the first confinement layer and has an extension which extends along and contacts both sides of the tapered extension of the one confinement layer.

Given that claims 5-13, are dependent on claim 1, the reasons argued for claim 1 are also applicable here. Also, Hammer '720 does not address the deficiencies of the AAPA and Wojnarowski et al. '458. Therefore, the proposed combination of AAPA, Wojnarowski et al. '458, and Hammer '720 does not render obvious claims 5-13.

Claims 21-26 are rejected under 35 USC §103 as being unpatentable over AAPA and Wojnarowski et al '458 in view of Carnevale et al., U.S. 4,412,722.

Carnevale et al. '722 describes an optical fiber which supports essentially only a single guided mode, perhaps degenerate, at the transmission wavelength, usually between 0.6 and 1.7 microns. The index of refraction of the core material is graded in the radial direction so as to yield an optical fiber with very low total dispersion and therefore high bandwidth. Specific embodiments include, in addition to the low dispersion characteristic, improved field confinement, and therefore permit lower clad-to-core ratios than heretofore believed practical. Additional advantages which accrue as a result of the greater field confinement include lower cabling, microbending, and curvature-induced losses.

Given that claims 21-26, are dependent on claim 1, the reasons argued for claim 1 are also applicable here. Also, Carnevale et al. '722 does not address the deficiencies of the AAPA and Wojnarowski et al. '458. Therefore, the proposed combination of AAPA, Wojnarowski et al. '458, and Carnevale et al. '722 does not render obvious claims 21-26.

Claims 37-38 are rejected under 35 USC §103 as being unpatentable over AAPA and Wojnarowski et al '458 in view of Joannopoulos et al., U.S. 5,955,749.

Joannopoulos et al. '749 describes a light emitting device comprising a substrate and a dielectric structure having at least a two-dimensionally periodic variation of dielectric constant which exhibits a spectrum of electromagnetic modes including guided modes of frequencies below a predetermined frequency cutoff and radiation modes of frequencies above and below said predetermined frequency cutoff, the two-dimensionally periodic variation of dielectric constant of the dielectric structure introducing a band gap between the guided modes. A radiation source, such as a quantum well, is associated with said structure, and generates electromagnetic radiation which couples to the radiation modes resulting in radiation extraction from the

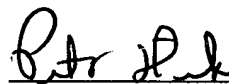
structure. The band gap allows the radiation to couple to radiation modes rather than to guided modes resulting in radiation extraction from the structure. The structure can be fabricated such that a radiation reflector is disposed between the structure and the substrate.

Given that claims 37-38, are dependent on claim 1, the reasons argued for claim 1 are also applicable here. Also, Joannopoulos et al. '749 does not address the deficiencies of the AAPA and Wojnarowski et al. '458. Therefore, the proposed combination of AAPA, Wojnarowski et al. '458, and Joannopoulos et al. '749 does not render obvious claims 37-38.

In view of the above amendments and for all the reasons set forth above, the Examiner is respectfully requested to reconsider and withdraw the objections and rejections made under 35 U.S.C. §§ 103 and 112, first and second paragraphs. Accordingly, an early indication of allowability is requested.

If the Examiner has any questions regarding matters pending in this application, please feel free to contact the undersigned below.

Respectfully submitted,



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